

# Logistics Delivering the milk

**Logistics** – planning the most efficient way of organising a task – is vital in the world of work.

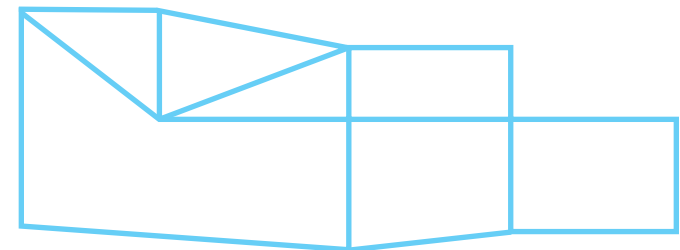
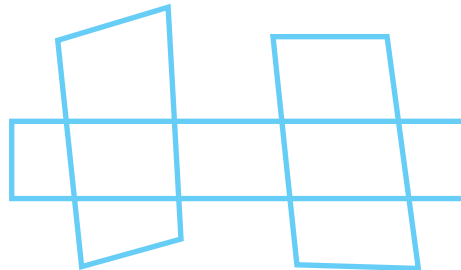
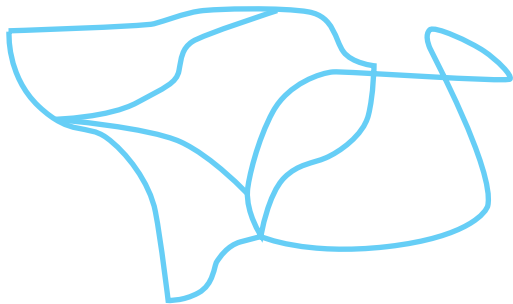
To deliver the milk, you need to **travel along every road** in the network.

- One of the networks has a **closed circuit**.
- One has an **open trail** – you can travel down each road once and only once but you don't end up where you started.
- For one of the networks, you **cannot** cover every road without going down some roads twice.

Problems in logistics usually involve looking for the quickest, shortest or cheapest route.

**Which sort of network is best for delivering the milk?**

## Which is which?



**Experiment** with some networks of your own.  
Find a rule to predict which networks have a **closed** circuit,  
an **open** trail or **cannot be done**.

# Logistics Finding cheap fares



Problems in logistics often involve looking for the **cheapest** route.

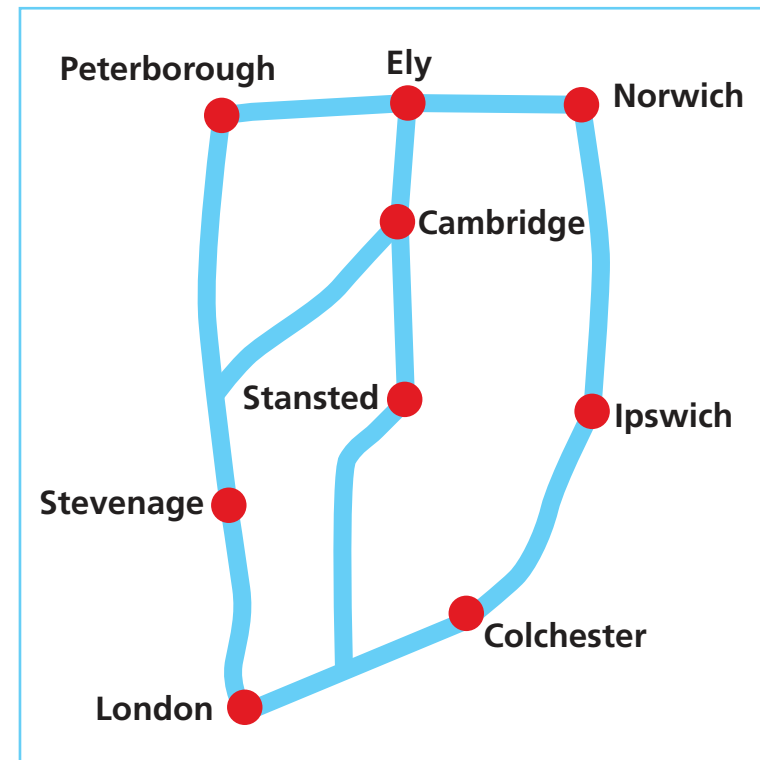
It is sometimes cheaper to buy **a series of tickets** for parts of a train journey than a **direct ticket** for the whole journey.

In network problems the number of different possibilities grows rapidly.

If you travel from London to Norwich via Colchester you need to consider **four** different ways of breaking up the journey. **Find them all.**

You can also travel from London to Norwich via Stansted.

How many different ways are there to break up this journey?

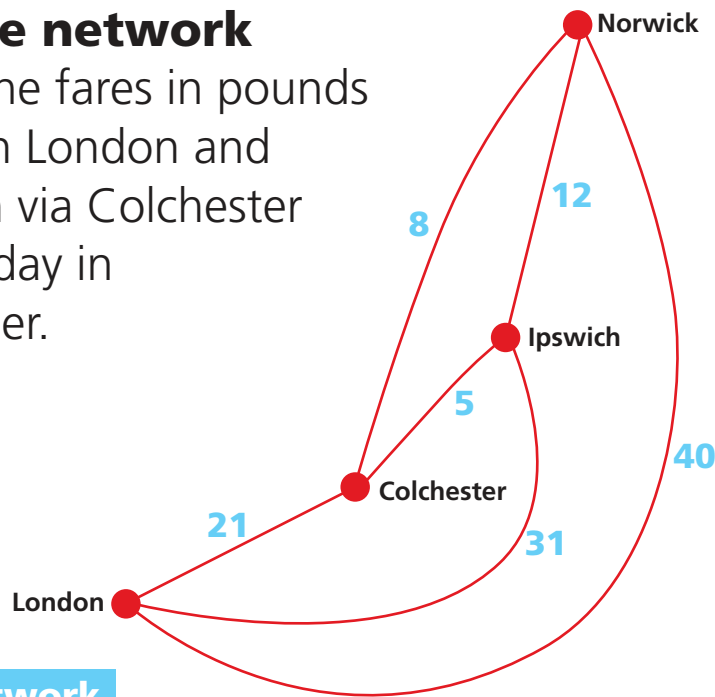


Rail map

**Challenge:** How many different ways are there of breaking the journey up altogether?

# Logistics Fare networks

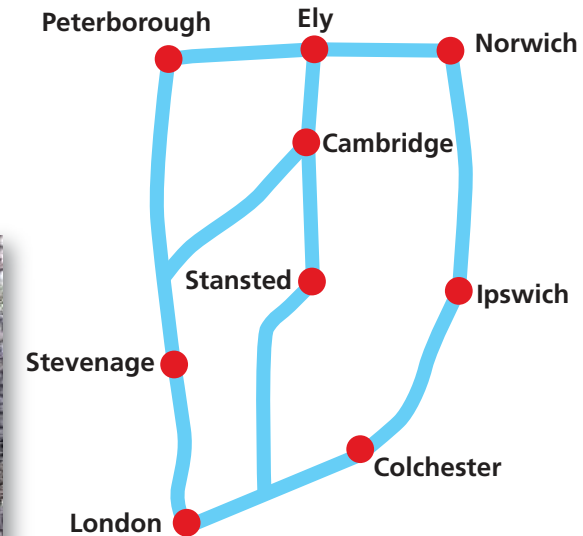
This **fare network** shows the fares in pounds between London and Norwich via Colchester on one day in December.



Fare network

Use the rail map below to draw two **fare networks** for:

- the journey via Stansted
- the journey via Stevenage.



Rail map

Which is the **cheapest way** to break up the **journey via Colchester**?

How many **different** possible fares are there from **London to Norwich**?

If you combine **all three fare networks**, the result is complicated.

Computers use **Dijkstra's shortest path algorithm** to solve problems like this.

You can see this working at [http://en.wikipedia.org/wiki/Dijkstra's\\_algorithm](http://en.wikipedia.org/wiki/Dijkstra's_algorithm)

# Logistics

## Topic

Logistics – planning the most efficient way of organising and completing a task – is fundamental to many careers. It is particularly significant in transportation and delivery systems. This topic draws on network theory to solve such problems and demands the use of mathematical process skills.



## Planning for teaching

In **Delivering the milk** three networks of streets are given. Only one of these, the centre one, is a closed circuit such that each street can be travelled once and only once. The left-hand network has an open trail: the streets can be travelled once and only once but the start and finish are in different places. The right-hand network cannot be travelled without going down some streets more than once. The pupils work out which network has which characteristic and are then asked to experiment with networks of their own to find a simple rule for classifying the three different types of network. Encourage them to work in small groups and to share observations and conjectures. After some time, you may need to give a hint about marking the vertices and eventually, labelling each vertex with its order.

## Mathematical activities

Delivering the milk

Finding cheap fares

Fare networks

**Finding cheap fares** and **Fare networks** are two interconnected activities. **Finding cheap fares** uses a section of the rail network and is concerned with establishing all the possible fare structures for a given rail journey. To answer the final challenge question pupils will need to work carefully and systematically. **Fare networks** builds on this work but introduces a new kind of network – not one which shows the train track route but a network representing all the possible fares. This will not be immediately obvious to pupils – a whole class discussion about the given fare network comparing this network with the results from **Finding cheap fares** will be useful before pupils attempt to create their own fare networks for other possible routes for the given journey.





# Logistics

## Careers link-up

Transport Planning is one of many careers where logistics is involved. You could use the highlights from the 3 videos on

<http://icould.com/quick-search/?term=transport+planner> of Transport Planners as a starter or a homework activity for students to explore how you get to be a Transport Planner. The *icould* website has a wealth of case study videos of different people talking about their jobs and their career paths.

The *Inside Careers* website has more information on careers linked to logistics including transport planning – with case study profiles of recent graduates and senior people.

[http://www.insidecareers.co.uk/\\_802574D80054B660.nsf/id/83KGPFTDEN!opendocument](http://www.insidecareers.co.uk/_802574D80054B660.nsf/id/83KGPFTDEN!opendocument)



## Want to know more?

Contact STEM Subject Choice and Careers  
info@careersinstem.co.uk

The Centre for Science Education  
Sheffield Hallam University  
City Campus, Howard Street  
Sheffield S1 1WB

**Tel:** 0114 225 4870

or for more information on careers go to Maths careers at [www.mathscareers.org.uk/](http://www.mathscareers.org.uk/)  
or Future Morph at [www.futuremorph.org/](http://www.futuremorph.org/) <<http://www.futuremorph.org/>

A Department for Education initiative to promote subject choice and careers in Science, Technology, Engineering and Maths (STEM) delivered by the Centre for Science Education at Sheffield Hallam University and Babcock.

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